



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/286,160	04/05/1999	THEODORE E. BRUNING III	PD26112	4617

7590

01/10/2002

WILLIAM J KUBIDA
HOLLAND & HART LLP
POST OFFICE BOX 8749
555 SEVENTEENTH STREET SUITE 3200
DENVER, CO 80201-8749

EXAMINER

MCLEAN, KIMBERLY N

ART UNIT

PAPER NUMBER

2185

DATE MAILED: 01/10/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

H.G.

Office Action Summary

Application No.
09/286,160

Applicant(s)
BRUNING

Examiner
Kimberly McLean

Art Unit
2185



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Nov 13, 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- *See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
- 18) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other: _____

Art Unit: 2185

Request for Continued Examination

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on November 13, 2001 has been entered and thus the Filgate reference (USPN: 6,178,521) has been withdrawn as prior art in lieu of the American Inventors Protection Act of 1999 (AIPA) which applies to all applications filed on or after November 29, 1999.

Claim Objections

2. Claims 1, 3-6, 8, 10-11, 13-20 are objected to because of the following informalities: .
Appropriate correction is required.

Claim 1, lines 4 and 5; claim 6, lines 5 and 6; claim 13, lines 5 and 6; claim 14, line 3; claims 15-16, lines 1 and 2; claim 17, line 1; claim 18, line 3 and claims 19-20, lines 1 and 2 state, "the disks". This should state, "..the plurality of disks..".

Claim 1, line 7 and claim 14 line 5 state, "..striping the redundant arrays". This should state, "..striping the plurality of redundant arrays..".

Art Unit: 2185

Claim 3, lines 1-3 should state, "The apparatus of claim 1 wherein the plurality of back-end controllers each include a plurality of busses, each coupled to one and only one of the disks associated with each of the plurality of redundant arrays of disks".

Claim 4, lines 1-2 should state, "The apparatus of claim 1 wherein the plurality of back-end controllers comprises a RAID engine for presenting the plurality of disks as a plurality of RAID sets".

Claim 5, line 2 states, "..presenting the disks..". This should state, "..presenting the plurality of disks..".

Claim 6, line 7 states, "receiving the RAID sets". This should state, "receiving the plurality of RAID sets..".

Claim 6, line 8-9, "presenting the striped RAID sets..". This should state, "presenting the striped member RAID sets..".

Claim 8, lines 5-6 state, "a plurality of groups of $X + 1$ disks, each group being coupled to one of the back-end controller busses..". This should say, "a plurality of groups of $X + 1$ disks, wherein each disk in the group is coupled to one of the N busses associated with one of the plurality of back-end controller busses". Figures 1A and 1B depict each disk in a group coupled to one of the N busses associated with one of the plurality of back-end controller busses. Correction is required.

Claim 8, line 7 and claim 13, line 7 state, "..coupled to the back-end controllers..". This should state, "..coupled to the plurality of back-end controllers..".

Art Unit: 2185

Claim 8, lines 8-9 should state, “..the X N-member RAID sets as members, striping the X N-member RAID sets, and presenting the striped X N-member RAID sets as a virtual volume..”.

Claim 10 states, “cloning”. Clarification of the term is required. With respect to the specification (page 2, lines 13-16 and page 4, lines 15-18), the term has been interpreted in the claim to mean an off-line backup of data.

Claim 11, line 2 states, “..coupled to at least some of the back-end controllers..”. This should state, “..coupled to at least some of the plurality of the back-end controllers..”.

Claim 11, line 3 states, “..presenting the striped RAID sets”. This should state, “..presenting the striped member RAID sets..”.

Claim 13, lines 8-9 should state, “the plurality of redundant arrays of disks and presenting the striped redundant arrays of disks as the virtual volume..”.

Claims 15-17 and 19-20, line 1 omit “the act”.

Claim 17, line 5 states, “..coupling the disks to the back-end controllers..”. This should state, “..coupling the plurality of disks to the one or more back-end controllers..”.

Claim 17, line 6 states, “..to no more than one disk from each redundant array of disks..”. This should state, “..to no more than one disk from each of the plurality of redundant arrays of disks..”.

Claim 18, lines 5-6 states, “..the redundant arrays of disks..”. This should state, “..the plurality of redundant arrays of disks..”.

Art Unit: 2185

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-2, 4, 6, 8 and 13-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Massiglia, The RAID Book.

Regarding claims 1, 4 and 6, Massiglia discloses a plurality of disks (Page 151, Figure 73; Page 153, Figure 74); a plurality of back-end controllers (RAID Engine) coupled to the plurality of disks for organizing and presenting the plurality of disks as a plurality of redundant arrays of disks (Figure 73, page 151; Figure 74, page 153 - lower array management function(s)/ Mirroring Array Management Function(s)); a front-end controller (Stripe Engine) coupled to the plurality of back-end controllers for striping the plurality of redundant arrays of disks and presenting the striped array as a virtual volume (Figure 73, page 151; Figure 74, page 153 - upper array management function/ Striping Array Management Function). Figures 73 and 74 represent the mirroring array management function(s) as multiple separate entities. The mirroring array management function controls the operations of the disk(s) attached to it and thus functions as a controller (Page 8, Section Titled "Disk Arrays"; Page 10, Section Titled "The Role of the Array Management Function in Disk Arrays"). The striping array management function controls the operations of the disk attached to it and thus functions as a controller. Additionally, Massiglia

Art Unit: 2185

describes the array management function(s) as a body of software or firmware which inherently executes in a hardware device.

Regarding claim 2, Massiglia discloses mirrored disks. Mirrored disks inherently consists of a pair of disks, wherein one disk is the active disk and the other disk is a spare (replacement) disk used when the active disk fails. Therefore, Massiglia discloses the plurality of disk including one or more spare disks.

Claim 8 has been rejected with the interpretation that each disks in the plurality of groups of $X + 1$ disks are each coupled to one of the N busses associated with one of the plurality of back-end controller. See claim objection above.

Regarding claim 8, Massiglia discloses an apparatus for providing a virtual volume, the apparatus comprising a plurality of back-end controllers (Figure 73 - Page 151, the lower Array Management Function(s)/ mirroring Array Management Function(s)) each configured to organize and present X N -member RAID sets (Figure 73 - wherein X is equal to one and N is equal to two), and each having N busses (Figure 73 - connections between the mirroring array management functions and the disks represented by the arrows) capable of supporting $X + 1$ disks (corresponding disks coupled to each mirroring array management function); a plurality of groups of $X+1$ disks (Figure 73, a group consists of the two disk ($X + 1$) coupled to a corresponding back-end controller), each group being coupled to one of the back-end controller

Art Unit: 2185

busses (Page 151, Figure 73- busses represented by the arrows between the disk(s) and the mirroring array management functions); and a local front-end controller coupled to the back-end controllers for receiving the RAID sets as members, striping the member RAID sets, and presenting the striped RAID sets as a virtual volume (Figure 73 - Page 151, upper Array Management Function/striping array management function). Figure 73 represents the mirroring array management function(s) as multiple separate entities. The mirroring array management function controls the operations of the disk(s) attached to it and thus functions as a controller (Page 8, Section Titled "Disk Arrays"; Page 10, Section Titled "The Role of the Array Management Function in Disk Arrays"). The striping array management function controls the operations of the disk attached to it and thus functions as a controller. Additionally, Massiglia describes the array management function(s) as a body of software or firmware which inherently executes in a hardware device.

Regarding claims 13-15, Massiglia discloses an electronic system comprising a computer (host computer (inherent); Page 6); and an apparatus coupled to the computer for presenting a virtual volume to the computer (hybrid RAID array - Figure 73, Figure 74); a plurality of disks (Page 151, Figure 73; Page 153, Figure 74); a plurality of back-end controllers (lower array management function(s)/ Mirroring Array Management Function(s)) coupled to the disks for organizing and presenting the disks as a plurality of redundant arrays of disks (Page 151, 153 - lower Array Management Function/ mirroring Array Management Function); a front-end

Art Unit: 2185

controller (stripe engine) coupled to the back-end controllers for striping the redundant arrays of disks and presenting the striped array as a virtual volume (Page 151, 153 - upper Array Management Function/striping array management function); and writing data to the virtual volume (inherent). Figures 73 and 74 represent the mirroring array management function(s) as multiple separate entities. The mirroring array management function controls the operations of the disk(s) attached to it and thus functions as a controller (Page 8, Section Titled "Disk Arrays"; Page 10, Section Titled "The Role of the Array Management Function in Disk Arrays"). The striping array management function controls the operations of the disk attached to it and thus functions as a controller. Additionally, Massiglia describes the array management function(s) as a body of software or firmware which inherently executes in a hardware device.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 3 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Massiglia, The RAID Book in view of Griffith (USPN: 6,330,687).

Regarding claim 3, Massiglia discloses the limitations cited above in claim 1, additionally, Massiglia discloses each back-end controller including a plurality of busses (connections

Art Unit: 2185

represented by the arrows in Figure 73; connections coupled to member disk 2, member 3 and mirroring array management function and connections coupled to member disk 0, member disk 1). However, Massiglia does not disclose each back-end controller bus coupled to one and only one of the disk associated with each of the redundant array of disks. However, Griffith teaches the concept of each controller being coupled to one and only one of the disk associated with each of the redundant array of disks (Figure 3, References, 1-6). Figure 3 shows that each channel reference (s) 1-6 are each connected to one of the disk from each redundant array. Channel 1 is coupled to References 40, 141, Channel 2 is coupled to References 42, 143, etc. Griffith teaches that this configuration allows one of the controllers access to the disk coupled to the other controller in the event of a failure of the other controller thereby extending the protection of the operation of the RAID system (C 43-65; Abstract). In Massiglia's teachings the busses are coupled to one of the disk in one of the redundant arrays and not to one of the disk in each of the redundant arrays, thereby yielding the system to decreased reliability. One of ordinary skill in the art would have recognized the shortcomings of Massiglia's teachings and would have been motivated to use the teachings of Griffith with the teachings of Massiglia for the desirable purpose of increased reliability.

Regarding claim 17, Massiglia discloses the limitations cited above in claim 14, additionally, Massiglia discloses one or more back-end controllers (Figure 74, mirroring array management functions), each having a plurality of busses, wherein each bus is coupled to one of the disk of

Art Unit: 2185

one of the redundant arrays and to a spare disk (bus coupled to Member disk 2, member disk 3- spare disk and to mirroring array management function and the bus coupled to member disk 0, member disk 1- spare disk and to the mirroring array management function). Massiglia does not disclose each back-end controller bus coupled to one and only one of the disk associated with each of the redundant array of disks. However, Griffith teaches the concept of each controller being coupled to one and only one of the disk associated with each of the redundant array of disks (Figure 3, References, 1-6). Figure 3 shows that each channel reference (s) 1-6 are each connected to one of the disk from each redundant array. Channel 1 is coupled to References 40, 141, Channel 2 is coupled to References 42, 143, etc. Griffith teaches that this configuration allows one of the controllers access to the disk coupled to the other controller in the event of a failure of the other controller thereby extending the protection of the operation of the RAID system (C 43-65; Abstract). In Massiglia's teachings the busses are coupled to one of the disk in one of the redundant arrays and not to one of the disk in each of the redundant arrays, thereby yielding the system to decreased reliability. One of ordinary skill in the art would have recognized the shortcomings of Massiglia's teachings and would have been motivated to use the teachings of Griffith with the teachings of Massiglia for the desirable purpose of increased reliability.

7. Claims 5, 7 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Massiglia, The RAID Book.

Art Unit: 2185

Regarding claims 5, 7 and 16, Massiglia discloses the features cited above in claims 4, 6 and 15, however, Massiglia does not explicitly disclose the RAID engine as a RAID 5 engine and organizing the plurality of disks as a plurality of RAID-5 sets. Massiglia does teach that a RAID 5 provides a simple mechanism for providing data protection using bit-by-bit parity (Page 102, 1st Paragraph). This feature provides reliability. One of ordinary skill in the art would have recognized the benefits provided by a RAID 5 system and would have been motivated to organize the plurality of disks as a RAID 5 and use a RAID 5 engine with the teachings of Massiglia for the desirable purpose of increased reliability.

8. Claims 9, 11-12 and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Massiglia, The RAID Book in view of Matoba (USPN: 5,611,069).

Regarding claim 9, Massiglia discloses the limitations cited above in claim 8, however, Massiglia does not disclose the local front-end controller generating mirror sets from the RAID sets received as members from different back-end controllers. However, Matoba teaches the concept of a controller, generating mirror RAID sets and striping the mirrored RAID sets (Figure 5A, Reference 60; C 11, L 29-65) which provides flexibility. In Massiglia's teachings mirroring is performed via a lower Array Management Function and striping is performed via an upper Array Management Function. In the event of a failure of the lower Array Management Function, the system would not be able to control the operation of the mirrored disks. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to also

Art Unit: 2185

generate mirror sets from the RAID sets using the front end controller in Massiglia's system for the desirable purpose of improved reliability and flexibility.

Regarding claims 11-12, Massiglia discloses the limitations cited above in claim 8, however, Massiglia does not disclose a remote front-end controller coupled to at least some of the back-end controllers for receiving RAID sets as members, striping the member RAID sets and presenting the striped RAID sets as a virtual volume. However, Official Notice is taken that it is well known in the art to provide a redundant controller at a remote location to provide data recovery and to increase the reliability of the system in the event of an entire system failure due to disasters such as an earthquake, fire, explosion, hurricane, etc. Massiglia's's local front-end controller performs the above features. Massiglia's system does not provide any measures for data recovery in the event of a failed array management function (controller). Hence, it would have been obvious to one of ordinary skill in the art at the time the invention was made to add a remote (redundant) front-end controller coupled to at least some of the plurality of back-end controllers for receiving RAID sets as members, striping the member RAID sets and presenting the striped RAID sets as a virtual volume to the teachings of Massiglia for the desirable purpose of data recovery and increased reliability.

Additionally, with respect to claim 12, as stated above in claim 9, it would have been desirable to provide a local front end controller, (which performs data mirroring and striping), which is configured to generate mirror sets from received RAID sets, to stripe the mirror sets and to

Art Unit: 2185

present the striped mirror sets as the virtual volume to Massiglia's system and thus it would also be desirable and obvious to one of ordinary skill in the art at the time the invention was made to add a remote front-end controller which performs redundant functions of the local front-end controller to the teachings of Massiglia for the desirable purpose of data recovery and increased reliability.

Regarding claims 18-19, Massiglia discloses a method of storing data on a plurality of disk, the method comprises, using a plurality of back-end controllers, organizing the disks into a plurality of redundant arrays of disks (Figure 73, page 151; Figure 74, page 153 - lower array management function/Mirroring Array Management Functions; using at least one front-end controller, striping mirror sets from the redundant arrays of disks together to form a virtual volume (page 151, 153 - upper array management function - Striping Array Management Functional Unit - Figure 73, Figure 74) and writing data to the virtual volume. Figures 73 and 74 represent the mirroring array management function(s) as multiple separate entities. The mirroring array management function controls the operations of the disk(s) attached to it and thus functions as a controller (Page 8, Section Titled "Disk Arrays"; Page 10, Section Titled "The Role of the Array Management Function in Disk Arrays"). The striping array management function controls the operations of the disk attached to it and thus functions as a controller. Additionally, Massiglia describes the array management function(s) as a body of software or firmware which inherently executes in a hardware device. Massiglia does not disclose the at least one front-end controller

Art Unit: 2185

forming mirror sets from the redundant arrays of disk. However, Matoba teaches the concept of a controller (Figure 5A, Reference 60), generating mirror RAID sets and striping the mirrored RAID sets (C 11, L 29-65) which provides flexibility. In Massiglia's teachings mirroring is performed via a lower Array Management Function and striping is performed via an upper Array Management Function. In the event of a failure of the lower Array Management Function, the system would not be able to control the operation of the mirrored disks. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to also generate mirror sets from the RAID sets using the front end controller in Massiglia's system for the desirable purpose of improved reliability and flexibility.

Regarding claim 20, Massiglia discloses the features cited above in claim 19, however, Massiglia does not explicitly disclose organizing the plurality of disks into a plurality of RAID-5 sets. Massiglia does teach that a RAID 5 provides a simple mechanism for providing data protection using bit-by-bit parity (Page 102, 1st Paragraph). This feature provides reliability. One of ordinary skill in the art would have recognized the benefits provided by a RAID 5 system and would have been motivated to use a RAID 5 system with the teachings of Massiglia for the desirable purpose of increased reliability.

9. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Massiglia, The RAID Book in view of Bergsten (USPN: 6,282,610) and Pinson (USPN: 6,256,748).

Art Unit: 2185

Regarding claim 10, Massiglia discloses the limitations cited above in claim 8, however, Massiglia does not explicitly disclose the plurality of back-end controllers including primary local, redundant local, cloning, primary remote, and redundant remote back-end controllers. Massiglia discloses primary local back-end controllers. However, Bergsten teaches the concept of providing multiple remote backup storage controllers for the purpose of increased reliability (C 1, L 26-40; C 3, L 41-62; C 4, L 21-28, L 60-62; C 5, L 44-54; Figure 1). Pinson teaches the concept of providing redundant (backup) local controllers for increased reliability (Figure 3a, 4, C 2, L 55-67; C 4, L 10-56). Additionally, Official Notice is taken that the concept of off-line data backups (cloning) is well known in the art as an efficient means to provide a redundant copy of data used in the primary system/storage to provide access to the data in the event of a failure in the primary system/storage. The teachings provided by Bergsten, Pinson and that which is known in the art all provide increased reliability through redundancy and for this reason it would have been obvious to one of ordinary skill in the art at the time the invention was made to use these teachings with the teachings of Massiglia for the desirable purpose of increased reliability.

Response to Arguments

10. Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection.

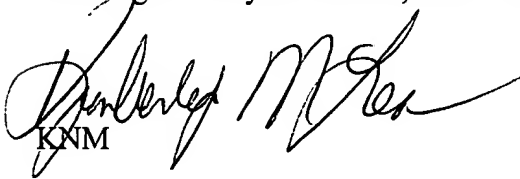
Art Unit: 2185

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kimberly McLean whose telephone number is (703) 308-9592 (e-mail address: Kimberly.McLean2@uspto.gov). If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Do Yoo, can be reached on (703) 308-4908.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

Any formal response to this action intended for entry should be mailed to Commissioner of Patents and Trademarks, Washington, D.C. 20231 or faxed to (703) 305-9051 and labeled "FORMAL" or "OFFICIAL". Any informal or draft communication should be faxed to (703) 308-6306 and labeled "INFORMAL" or "UNOFFICIAL" or "DRAFT" or "PROPOSED" and followed by a phone call to the Examiner at the above number. Hand-delivered responses should be brought to Crystal Park II, 2021 Crystal Drive, Arlington, VA., Sixth Floor (Receptionist).


KNM

January 8, 2002